

# **Stormwater Best Management Practices Demonstration Projects to Protect the Environment**

Miller Brewing Rain Garden and Bioretention Swale &  
MSOE Broadway Street Parking Lot Pervious Pavement  
Demonstration Projects



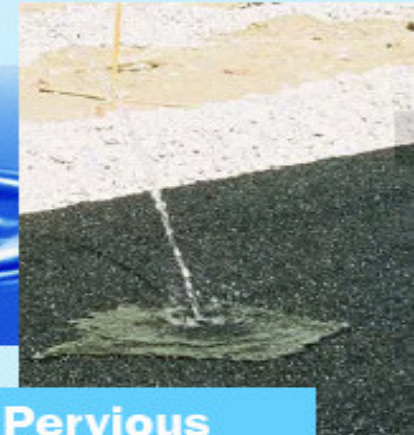
**The Milwaukee Cleaner River Conference  
November 17, 2005**

Presented by Willie Gonwa, P.E., Ph.D.  
Triad Engineering Incorporated  
414-291-8840

# Focus today will involve two stormwater control projects



Milwaukee School of Engineering



Pervious  
Parking Lot



[www.swallo](http://www.swallo)



# Acknowledgements

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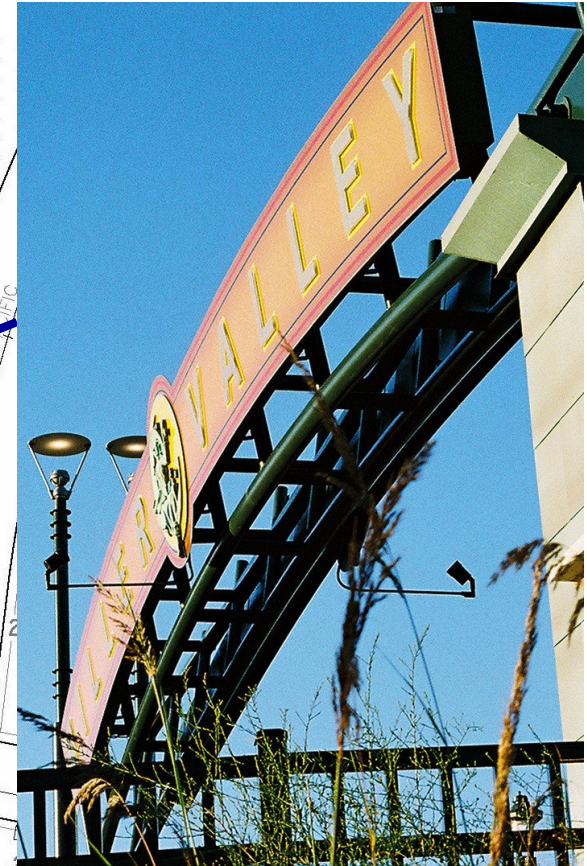
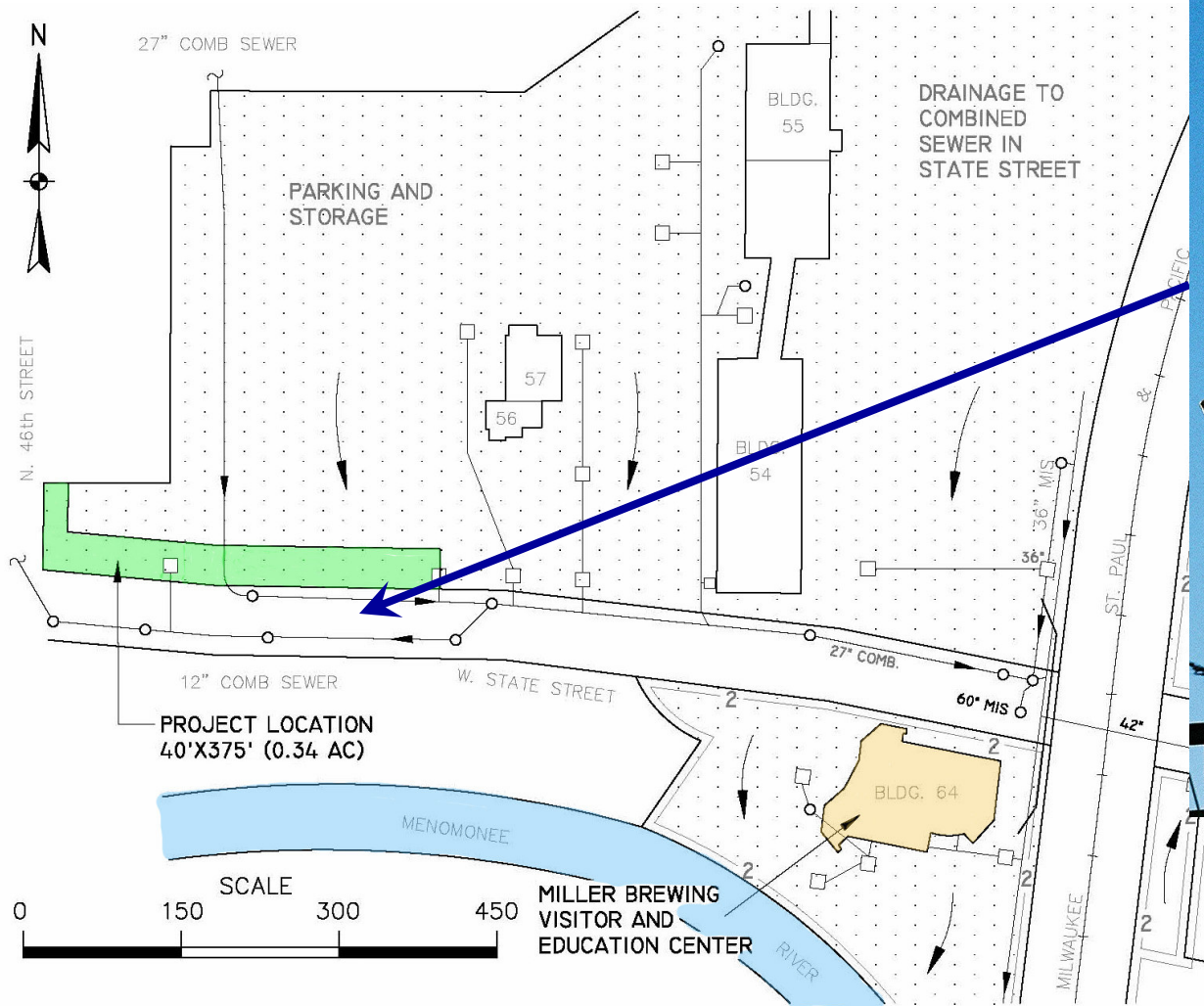


# MILLER BREWING RAIN GARDEN AND BIORETENTION SWALE





The project is located at the northeast corner of 46<sup>th</sup> and State Streets





Prior to installing the rain garden,  
contaminated runoff discharged directly to  
the combined sewers

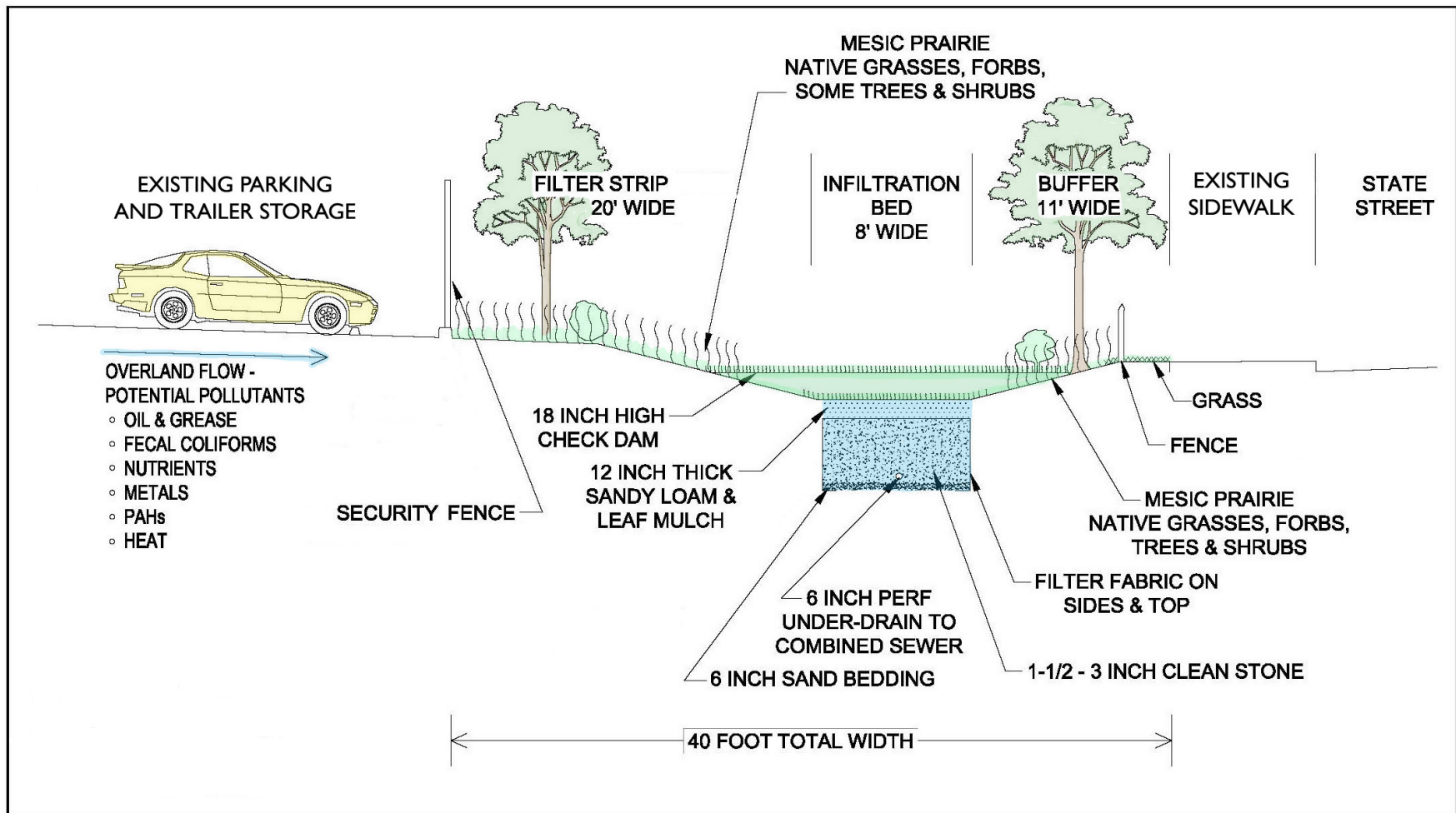




The green area indicates the approximate limits of the rain garden



# Elevation of Rain Garden





# Starting out





# Excavating the side slopes





A check dam retains water in the upper part of the project





The finished check dam  
was hidden by stone







A loamy-sand, mulch mixture on the bottom filters and absorbs rainwater



# A drain tile empties the bioretention swale





When full, the project  
discharges to a storm inlet





Hay bales protected the project until vegetation was established





We used several thousand live root stock native plants to vegetate the project





A serpentine  
stone path  
along the  
bottom  
breaks the  
project's  
linearity

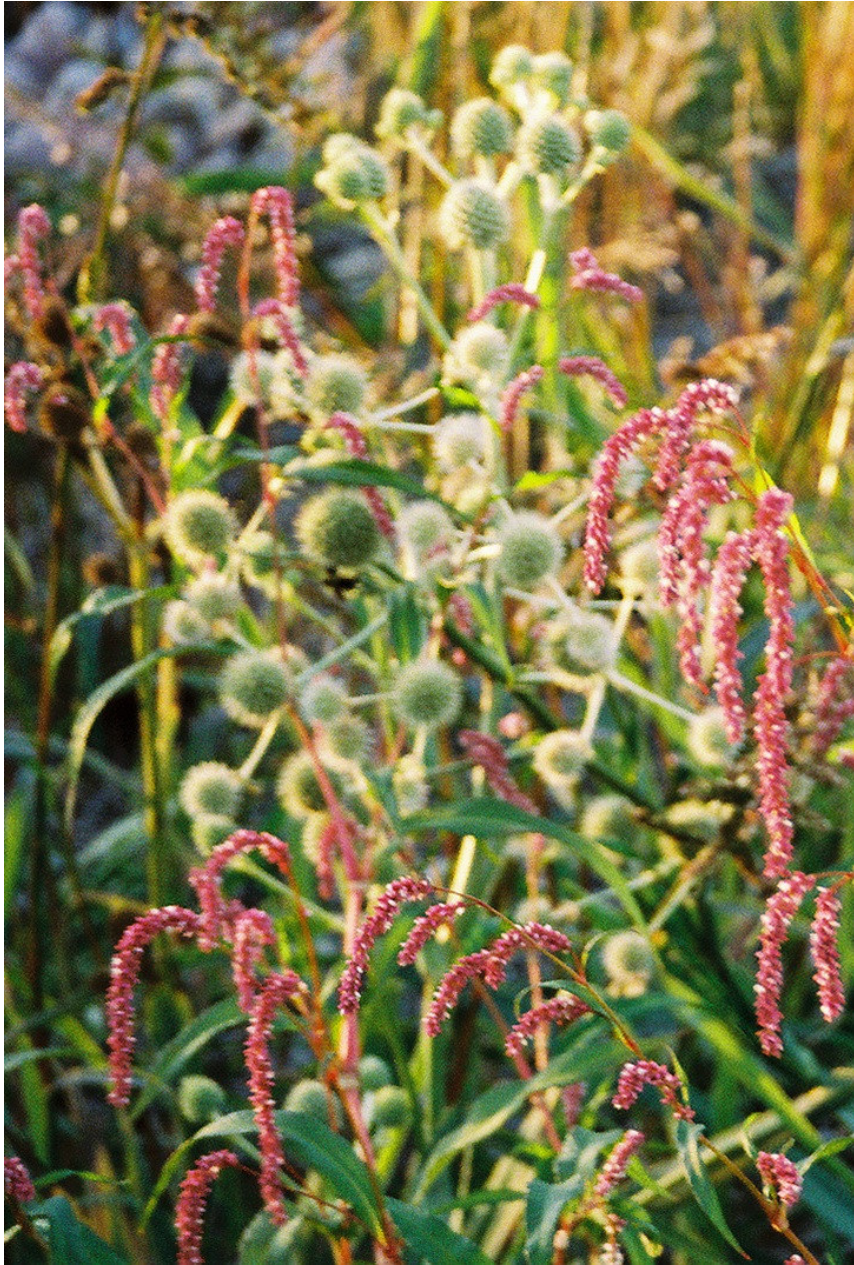




Plantings form swashes of color to emulate the prairie







## Flowers

New England Astor

Prairie Blazing Star

Ohio Goldenrod

## Trees

Kentucky Coffee

Professor Spranger

Crabapple

## Grasses

Switchgrass

Little Bluestem

India grass

Hops

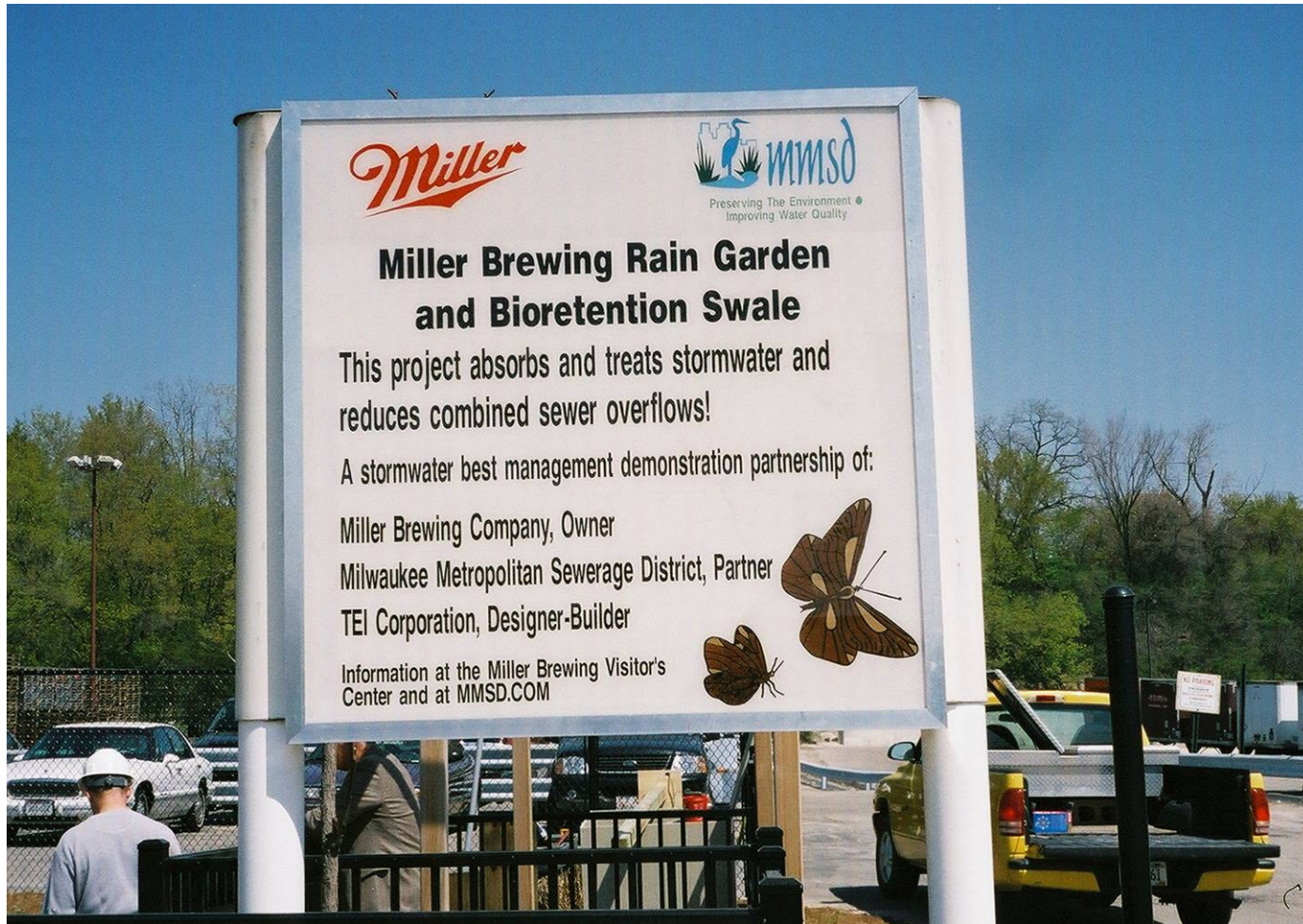


After one year's growth,  
vegetation is flourishing





# A large sign explains the purpose of the project





# A viewing terrace allows visitors to enjoy and learn about the garden





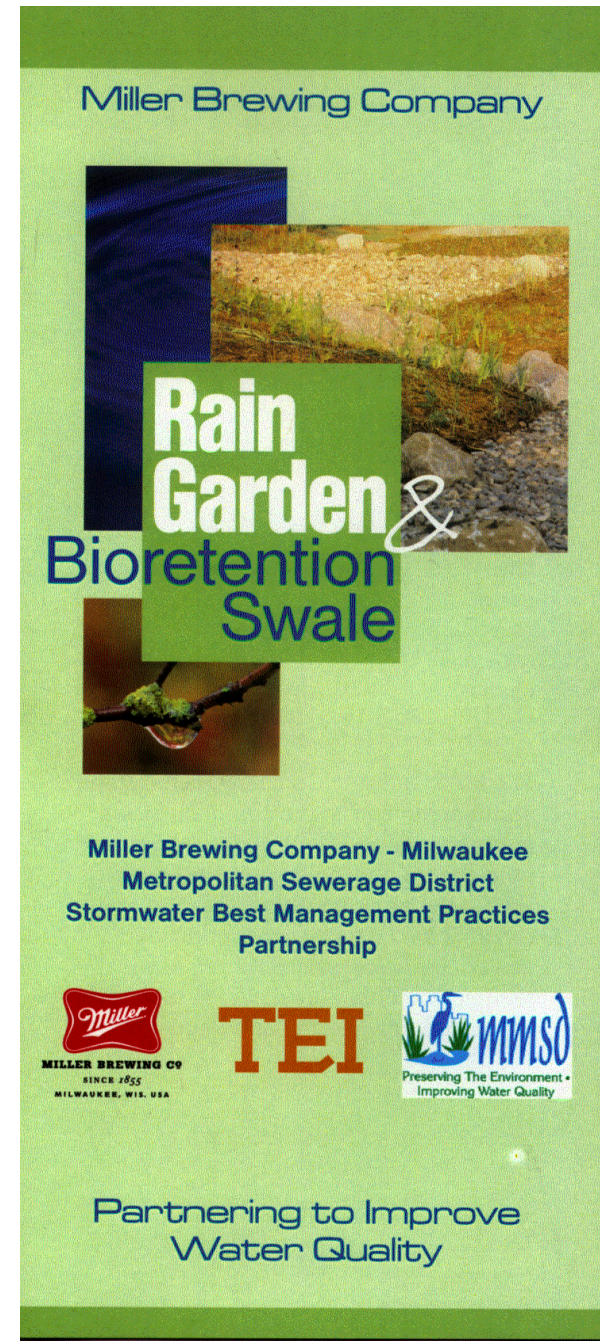
The visitor's center is located only 300 feet from the project.



During the life of the project, a half million people will have the opportunity to learn about the rain garden and bioretention swale



# An educational brochure describes the project to visitors





We installed  
monitoring  
equipment in  
April of 2005  
to document  
the project's  
effectiveness



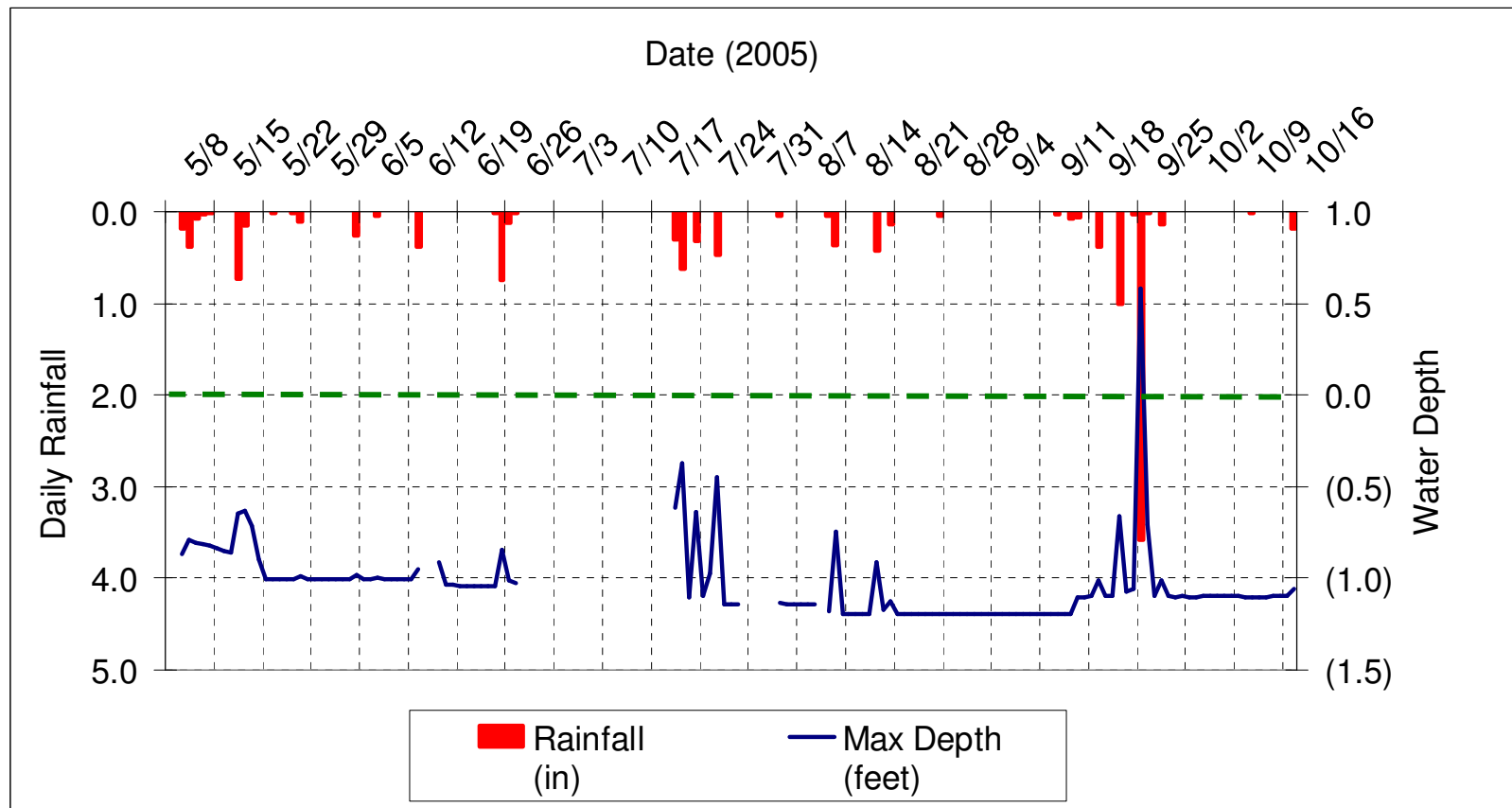


Monitoring includes measuring rainfall, effluent flow, and influent and effluent water quality





From May through October  
2005, the rain garden had just  
one discharge





Consensus: The project effectively slows and treats runoff in an extremely attractive manner.

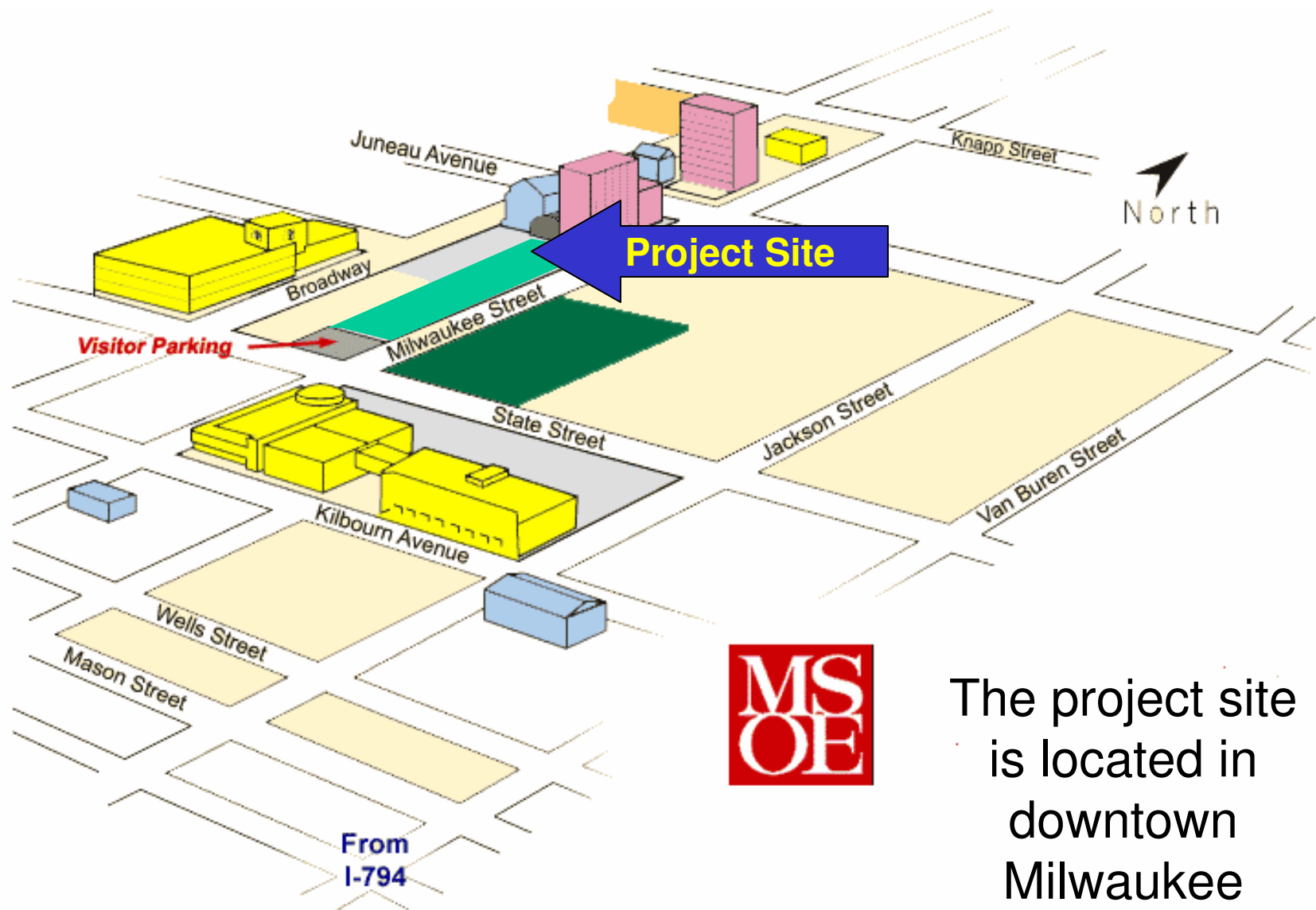




# MILWAUKEE SCHOOL OF ENGINEERING PERVIOUS PARKING LOT





























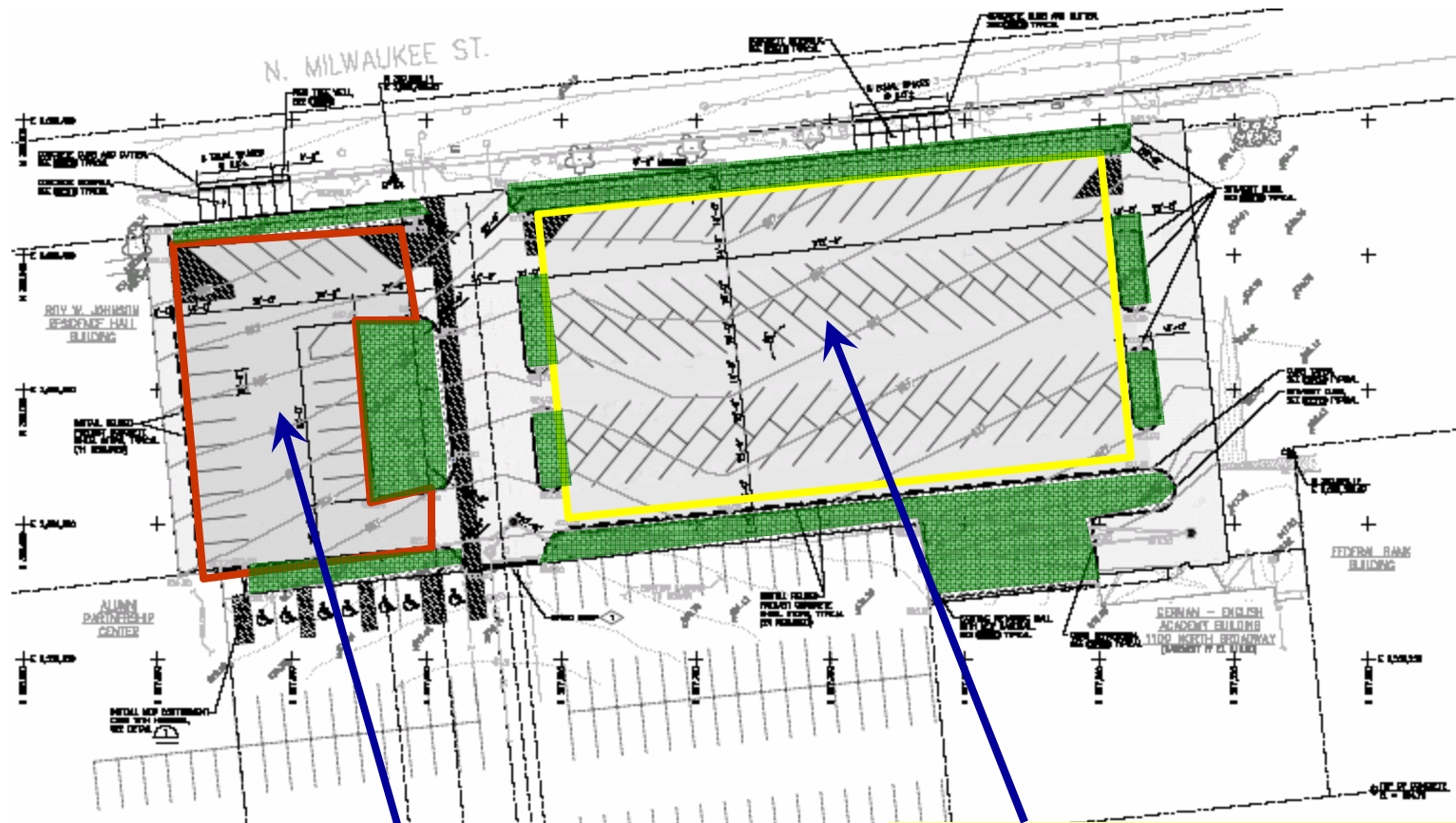
# Applicability

- Light Traffic
- Gentle Slopes (< 6%)
- Permeability of Soils > 0.5 in/hour
- Minimum 4 feet to bedrock or water table

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log
Number and Type	Length Att. & Recovered (in)					
1 GP	48 18		1	<b>0.0-0.25 FEET ASPHALT.</b>	ASPH	
			2	<b>0.25-2.0 FEET FILL;</b> mix of medium sand, fine to medium gravel and black (10YR 2/1) granular material; very dark grayish brown (10YR 3/2); moist.	FILL	
			3	<b>2.0-6.5 FEET SAND WITH SILT;</b> fine sand; dark yellowish brown (10YR 4/6); moist.	SW-SM	
			4			
			5			
2 GP	48 36		6	<b>6.5-7.0 FEET SAND;</b> medium; yellowish brown (10YR 5/6); moist.	SW	
			7			
			8	<b>7.0-10.0 FEET SAND AND GRAVEL;</b> fine to coarse, yellowish brown (10YR 5/6) sand; fine to coarse, subangular to subrounded gravel; little silt; moist.	SW-GW	
			9			
3 GP	24 24		10	<b>E.O.B. 10.0 FEET</b>		
				Borehole was abandoned with granular bentonite.		



# Site Plan



Pervious Concrete

Pervious Asphalt



















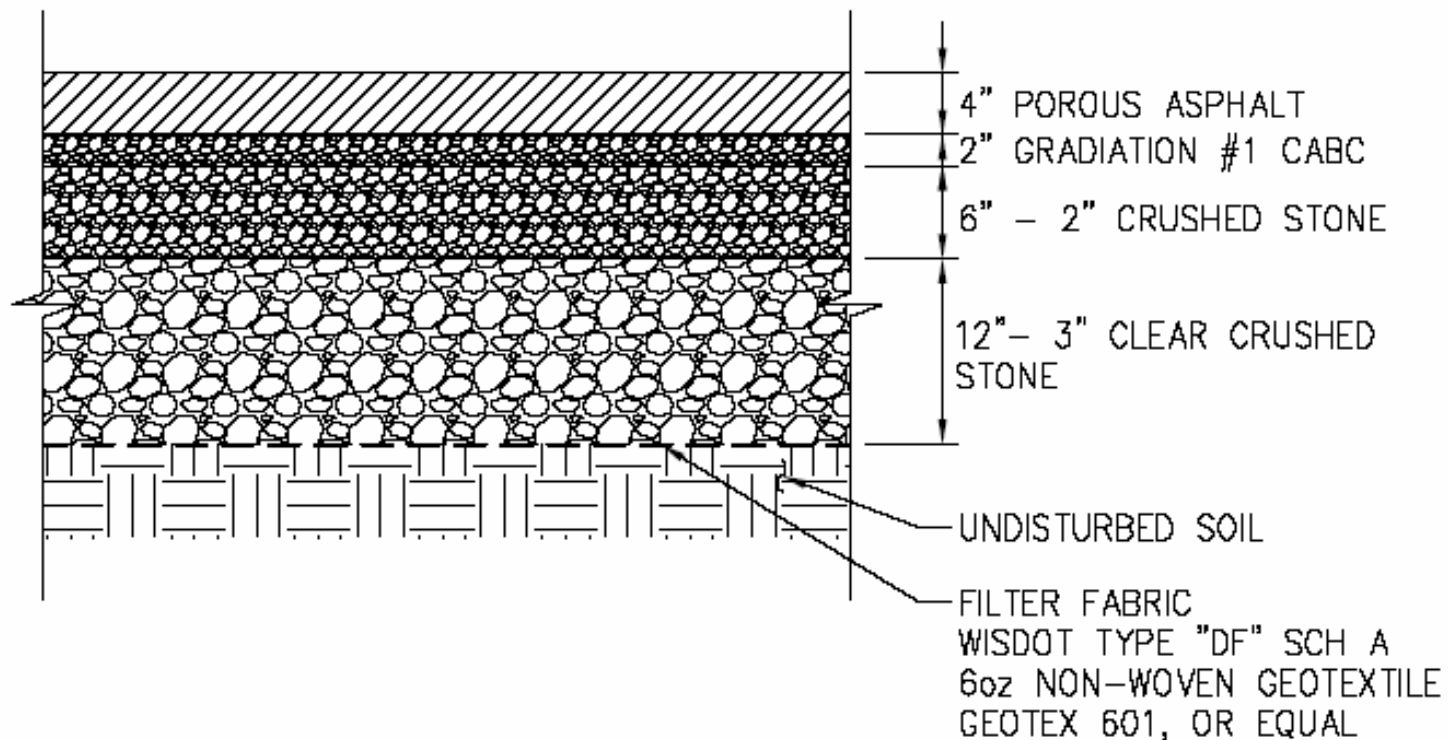








# Typical Pervious Asphalt Section



TYPICAL POROUS  
ASPHALT PAVEMENT DETAIL

SCALE: NONE

02402



















# Advantages of Pervious Pavement BMP

- Water treatment by pollutant removal
- Recharge to local aquifers (NR151)
- Less need for curbing and storm sewers
- Improved road safety because of better skid resistance
- Good application for a retrofit or constrained site



# Disadvantages of Pervious Pavement BMP

- Engineers and contractors lack experience in technology
- May clog if improperly installed or maintained
- High rate of failure
- Risk of groundwater contamination
- Plumbing code does not give credit
- Soft (asphalt)
- Rough texture with stone loss (concrete)



# The Major Question to Answer before Consensus on Technology

How will it survive in Wisconsin's winter?

